



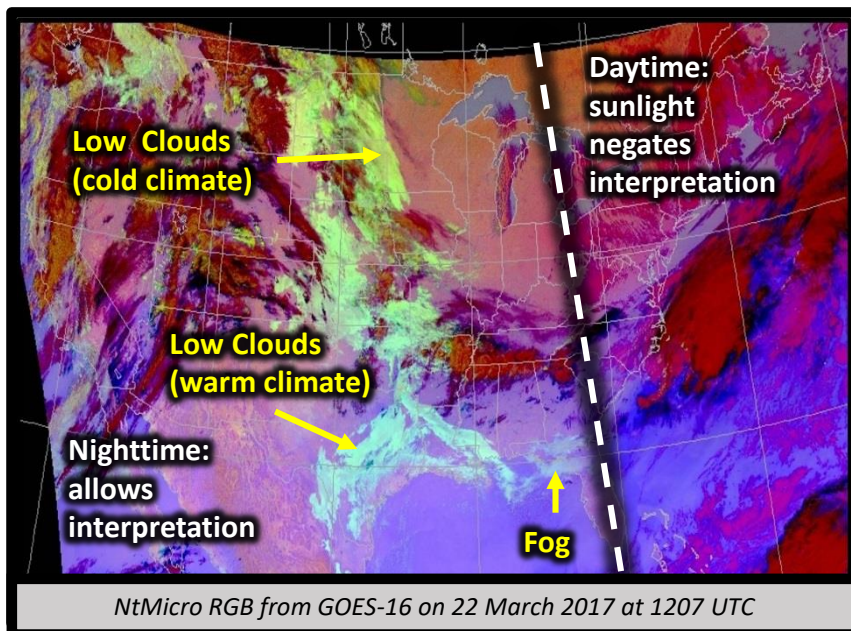
# Nighttime Microphysics RGB

## Quick Guide



### Why is the Nighttime Microphysics RGB Imagery Important?

The distinction between low clouds and fog in satellite imagery is often a challenge. While the difference in the 10.4 and 3.9  $\mu\text{m}$  channels has been a regularly applied product to meet aviation forecast needs, the Nighttime Microphysics (NtMicro) RGB adds another channel difference (12.4- 10.4  $\mu\text{m}$ ) as a proxy to cloud thickness and repeats the use of the 10.4  $\mu\text{m}$  thermal channel (see “Recipe” table) to enhance areas of warm (i.e. low) clouds where fog is more likely. The NtMicro RGB is also an efficient tool to quickly identify other cloud types in the mid and upper atmosphere.



### NtMicro RGB Recipe (Note: this applies best to opaque clouds. Semi-transparent clouds are influenced by underlying surface)

| Color | Band / Band Diff. ( $\mu\text{m}$ ) | Physically Relates to... | <u>Small</u> contribution to pixel indicates... | <u>Large</u> Contribution to pixel indicates... |
|-------|-------------------------------------|--------------------------|---|---|
| Red   | 12.4 – 10.4                         | Optical Depth            | Thin clouds                                     | Thick clouds                                    |
| Green | 10.4 – 3.9                          | Particle Phase and Size  | Ice particles; surface (cloud free)             | Water clouds with small particles               |
| Blue  | 10.4                                | Temperature of surface   | Cold Surface                                    | Warm surface                                    |

### Impact on Operations

#### Primary Application

#### Low clouds & fog

**analysis:** Low clouds and fog are aqua in warm regimes, but become more yellow to light green in cold regimes (i.e. decrease in blue component).

**Differentiate fog from low clouds:** Fog tends to appear “washed out” compared to low clouds. So, look for fog to have a less bright or near gray coloring.

**Efficient Cloud Analysis:** The multi-channel approach of the RGB allows for easy and quick discrimination of cloud types across the imagery.

**Secondary Applications:** Cloud height and phase, fire hot spots, moisture boundaries



### Limitations

#### Nighttime only

**application:** The shortwave IR band is impacted by solar reflectance during the day which impacts the 10.4 – 3.9 difference relationship.

**Thin fog blends with surface:** Thin radiation fog is semi-transparent allowing colder surface emissions to impact the 10.4  $\mu\text{m}$  band; thus, the resulting pixel color often has less blue than low clouds.

**Variable land/surface coloring:** The color of cloud free regions will vary depending on their temperature, surface type, and the column moisture.

**Shortwave IR noise in extreme cold:** Speckled yellow pixels appear in very cold clouds ( $\sim < -30^\circ\text{C}$ )





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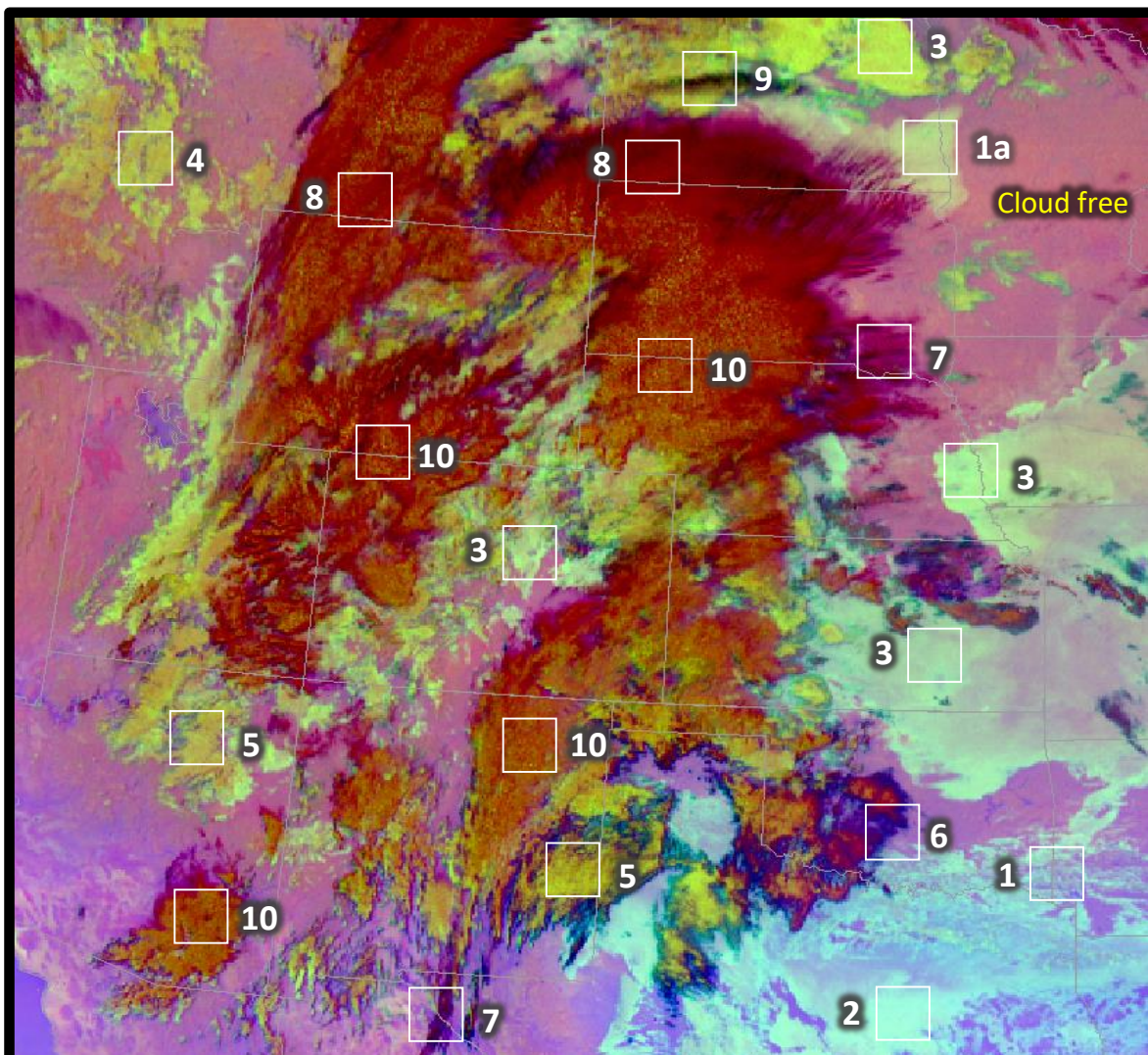
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### RGB Interpretation

- 1** Fog – warm regime (dull aqua to gray)
- 1a** Fog – cold regime (dull yellow-green to gray)
- 2** Very low, warm cloud (aqua)
- 3** Low, cool, cloud (bright green)
- 4** Mid water cloud (light green)
- 5** Mid, thick, water/ice cloud (tan)
- 6** High, thin, ice cloud (dark blue)
- 7** High, very thin, ice cloud (purple)
- 8** High, thick cloud (dark red)
- 9** High, opaque cirrus cloud (near black)
- 10** High, thick, very cold cloud (red/yellow, noisy)

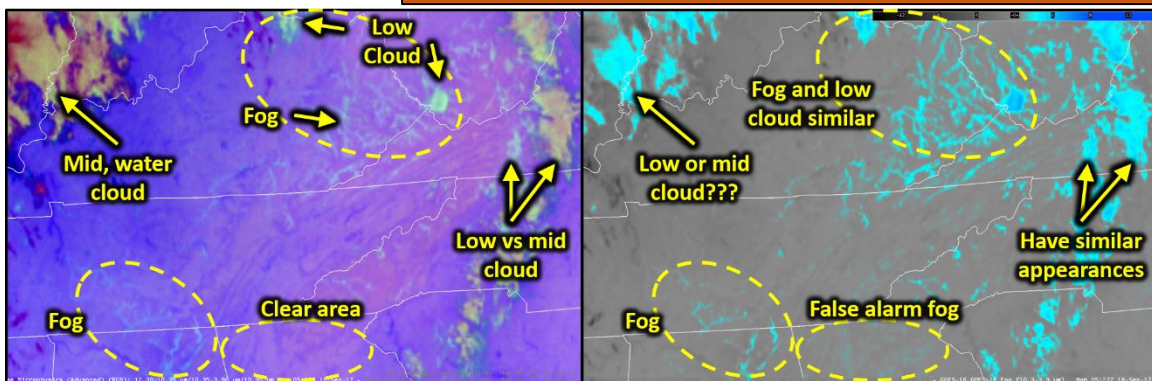
Note: colors may vary diurnally, seasonally, and latitudinally



NtMicro RGB from GOES-16 ABI at 1127 UTC, 28 March 2017.

### Comparison to Other Products (below)

The NtMicro RGB (left) helps to distinguish fog from clouds and “false alarm” features seen in the legacy “Fog” or 10.3-3.9  $\mu\text{m}$  channel difference (right). Recall the 10.3-3.9  $\mu\text{m}$  is also in the RGB.



### Resources

UCAR/COMET

[Multispectral Satellite](#)

[Applications: RGB Products](#)

[Explained](#)

NASA/SPoRT

[Nighttime Microphysics RGB](#)

[Module](#)

EUMETrain

[RGB Interpretation Guide](#)